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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/589,962	NAGASAKA, HIROYUKI	
	Examiner	Art Unit	
	Christina Riddle	2851	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 May 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/30/2006*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Status

1. Acknowledgment is made of the amendment filed on 5/13/2009 which amended claims 1, 12, 22, 27, 31, 35, and 36. Claims 1-37 are currently pending.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 11/30/2006 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 9, 11, 12, 22, 24, 26, 31, 36, and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Sugita (JP2000-021763, translation provided by applicant).

Regarding claim 1 and 11, Sugita teaches an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Abstract,

solution, an exposure method to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate) wherein

a substantial wavelength of an exposure light in a space between a projection optical system, which projects said exposure light on said photosensitive object, and said photosensitive object is different in at least one exposure in said plurality of times of exposure from another exposure (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure), and

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure (Abstract, solution, positions of the substrate are exposed by both fine and rough exposure), and after said plurality of areas are exposed by one of said at least one exposure and said another exposure, said plurality of areas are exposed by the other of said at least one exposure and said another exposure (Abstract, solution, the rough and fine exposure steps are overlapped on the same positions of the substrate).

Note regarding claims 9, 22, and 36: A different interpretation as necessitated by the amendment of claims 1, 12, and 31 is resulting in the limitations of claims 9, 22, and 36 being anticipated by Sugita as opposed to obvious over Sugita as originally

interpreted in the previous office action. Please see the response to arguments section for further discussion.

Regarding claim 9, Sugita discloses wherein a wavelength of an exposure light made to enter said projection optical system in said at least one exposure is different from a wavelength of exposure light in said another exposure (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure.).

Regarding claims 12, 26, 31, and 37, Sugita teaches an exposure method in which a plurality of times of exposure is performed on a same photosensitive object (Abstract, solution, an exposure method to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate), said method comprising:

exposing, under a first exposure condition where a substantial wavelength of said exposure light in a space between an optical member and said photosensitive object is a first wavelength, said photosensitive object is exposed by said exposure light of said first wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure.); and

exposing, under a second exposure condition where a substantial wavelength of said exposure light in a space between said optical member and said photosensitive object is a second wavelength different from said first wavelength, said photosensitive object is exposed by said exposure light of said second wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure), wherein

each of a plurality of areas on said photosensitive object is exposed by said plurality of times of exposure (Abstract, solution, positions of the substrate are exposed by both fine and rough exposure), and after said plurality of areas are exposed by one of the exposure under said first exposure condition and the exposure under said second exposure condition, said plurality of areas are exposed by the other of the exposure under said first exposure condition and the exposure under said second exposure condition (Abstract, solution, the rough and fine exposure steps are overlapped on the same positions of the substrate).

Regarding claim 22, Sugita discloses wherein a wavelength of an exposure light made to enter said projection optical system under said first exposure condition is different from the wavelength of exposure light in exposure under said second exposure condition (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with

a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure.).

Regarding claim 24, Sugita discloses said exposure under said first exposure condition and said exposure under said second exposure condition are severally executed in a different exposure apparatus (paragraphs [0053] and [0063], an F2 laser (Fig. 11) used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure).

Regarding claims 31 and 37, Sugita discloses an exposure system that performs exposure on a same photosensitive object a plurality of times (Abstract, solution, an system to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate), said system comprising:

a first exposure apparatus whose substantial wavelength of an exposure light in a space between said photosensitive object and a projection optical system, which projects said exposure light on said photosensitive object, is a first wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure.); and

a second exposure apparatus whose substantial wavelength of an exposure light in a space between said photosensitive object and a projection optical system, which projects said exposure light on said photosensitive object, is a second wavelength different from said first wavelength (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063],

an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure), wherein

each of a plurality of areas on said photosensitive object is exposed in said first exposure apparatus and said second exposure apparatus (Abstract, solution, positions of the substrate are exposed by both fine and rough exposure), and after said plurality of areas are exposed by one of the exposure with said exposure light of a said first wavelength and the exposure light of said second wavelength, said plurality of areas are exposed by the other of the exposure with said exposure light of said first wavelength and the exposure with said exposure light of said second wavelength (Abstract, solution, the rough and fine exposure steps are overlapped on the same positions of the substrate).

Regarding claim 36, Sugita discloses wherein oscillation wavelength of a light source emitting said exposure light of said first exposure apparatus is different from oscillation wavelength of a light source emitting said exposure light of said second exposure apparatus (paragraph [0024], in multiple exposure steps, the substrate is exposed with light of different wavelengths. Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 2-8, 13-21, 25, 27, 29, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita in view of Kudo (JP 10-340846, translation provided by applicant).

Regarding claims 2, and 6-8, Sugita teaches wherein in said another exposure, said space is in a state not filled with liquid (Figs. 11, 12, 13, 19, 20 and 24 are exposure apparatuses which have spaces between the projection lens and the photosensitive object not filled with liquid). Sugita also teaches that said at least one exposure is performed prior to said another exposure (Sugita, [0024], two exposure steps occur. Also, Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure). Sugita further teaches wherein said at least one exposure is performed after said another exposure is performed (Sugita, paragraphs [0024], [0053], and [0063], two exposure steps occur for a photosensitive object, one step in an exposure apparatus using a F2 laser light source and another step in an X-ray exposure apparatus).

However, Sugita does not appear to explicitly describe wherein in said at least one exposure, said space is in a state filled with a predetermined liquid.

However, Kudo teaches said space is in a state filled with a predetermined liquid (paragraph [0007], photosensitive object is exposed through a liquid with a controlled index of refraction).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object as shown by Kudo, in the exposure apparatus of Sugita since an immersion fluid is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature sizes.

Regarding claim 3, Sugita as modified by Kudo, as detailed in claim 2 above, further teaches wherein in said another exposure, said space is in a state filled with another liquid of a different type from said predetermined liquid (Kudo paragraph [0032], index of refraction of liquid is adjusted by adding ethyl alcohol to water, creating an immersion liquid of a different type).

It would have been obvious to one skilled in the art at the time of the invention to have included a different type of liquid filling the space between the projection system and the photosensitive object as shown by Kudo, in the exposure apparatus of Sugita since, as suggested by Kudo, an immersion fluid with a different type of liquid is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 4, Sugita as modified by Kudo as detailed in claim 3 above, further teaches said predetermined liquid has refractive index larger than the refractive index of said another liquid (Kudo [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as shown by Kudo, in the exposure apparatus of Sugita since an immersion fluid different refractivity is commonly used to allow improved control of numerical aperture for different process conditions.

Regarding claim 5, Sugita as modified by Kudo as detailed in claim 3 above, further teaches said another liquid has solubility to a specific material contained within a photosensitive agent of said photosensitive object lower than said predetermined liquid (Kudo paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as shown by Kudo, in the exposure apparatus of Sugita since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claims 13 and 19-21, Sugita, as detailed in claim 12, teaches wherein exposure under said second exposure condition is a dry exposure performed in a state where said space is not filled with liquid (Sugita paragraphs [0053] and [0063], an F2 laser exposure apparatus and an X-ray exposure apparatus (Fig. 13) were used for a second exposure, which are both dry exposure methods). Sugita further teaches said exposure under said first exposure condition is performed prior to said exposure under said second condition (Sugita, [0024], two exposure steps, one must occur before the other and both the F2 laser and X-ray exposure apparatuses are performed without liquid), and that said exposure under said first exposure is performed after said exposure under said second exposure has been performed (Sugita, [0024], two exposure steps, one must occur before the other and both the F2 laser and X-ray exposure apparatuses are performed without liquid). However, Sugita does not appear to explicitly describe wherein exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid.

However, Kudo discloses wherein exposure under said first exposure condition is an immersion exposure performed in a state where said space is filled with a predetermined liquid (paragraph [0007], photosensitive object is exposed through a liquid, with a refractive index adjustment device (and thus, controlling the liquid to a predetermined index of refraction)).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the

photosensitive object as shown by Kudo, in the exposure apparatus of Sugita since an immersion fluid is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature sizes.

Regarding claim 14, Sugita, as modified by Kudo, as detailed in claim 13 above, further teaches wherein exposure under said second exposure condition is an immersion exposure performed in a state where said space is filled with another liquid different from said predetermined liquid (paragraph [0030], a liquid additive of a different type fills the space).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object with a second liquid different from the first as shown by Kudo, in the exposure apparatus of Sugita in view of Kudo since an immersion fluid with a different index of refraction is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature size.

Regarding claims 15 and 16, Sugita, as modified by Kudo, as detailed in claim 14 above, further teaches wherein said predetermined liquid has a refractive index different from and larger than said another liquid (paragraph [0030], a liquid additive of a different type, and thus a different refractive index, fills the space, and Kudo [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as shown by Kudo, in the exposure apparatus of Sugita since an immersion fluid different refractivity

is commonly used to allow improved control of numerical aperture for different process conditions.

Regarding claims 17 and 18, Sugita, as modified by Kudo, as detailed in claim 14 above, further teaches said another liquid has solubility to a specific material contained within a photosensitive agent of said photosensitive object different and smaller than said predetermined liquid (Kudo paragraph labeled [A 2nd embodiment], between paragraphs [0029] and [0030], ethyl alcohol is used as an additive to water to avoid dissolving the photosensitive agent on the surface of the photosensitive object).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid with a lower solubility to material in photosensitive agent than another liquid as shown by Kudo, in the exposure apparatus of Sugita since, as suggested by Kudo, an immersion fluid with a lower solubility to a photosensitive agent is commonly used to prevent dissolution of the photosensitive layer of resist on the surface of the photosensitive object (paragraph labeled [Second Embodiment]).

Regarding claim 25, Sugita, as detailed in claim 12 above, does not appear to explicitly describe wherein said exposure under said first exposure condition and said exposure under said second exposure condition are severally executed in a same exposure apparatus.

However, Kudo teaches said exposure under said first exposure condition and said exposure under said second exposure condition are severally executed in a same exposure apparatus (paragraph [0030], a liquid additive of a different type, and thus a different refractive index, fills the space, thus causing the exposure wavelength to be a

different wavelength through the liquid medium. The same exposure apparatus can cause the two different exposure conditions by controlling the index of refraction).

It would have been obvious to one skilled in the art at the time of the invention to have one exposure apparatus capable of performing both exposure conditions as shown by Kudo, in the exposure system of Sugita since an exposure apparatus that performs both exposure conditions is commonly used in the art to increase equipment utilization and flexibility as well as to decrease equipment footprint in a semiconductor manufacturing site.

Regarding claims 27 and 30, Sugita teaches an exposure apparatus that performs a plurality of times of exposure on a same photosensitive object (Abstract, solution, an exposure system to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate), said apparatus comprising: a stage that holds said photosensitive object (Figs. 11 and 13, stages 215 and 228, and for an exemplary exposure apparatus, Fig. 24 with stage 199); a projection optical system that projects an exposure light on said photosensitive object (Figs. 11 and 13, projection system 212 and 213, projects light onto object, wafer, 214, and the system of Fig. 13 between the reticle 225 and the object 227. Also, exemplary exposure apparatus Fig. 24 with projection system 196 projecting light onto object, wafer, 198), and in at least one exposure of said plurality of times, said substantial wavelength of said exposure light in said space is different from the wavelength in another exposure (paragraph [0024], and Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first

exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure). However, Sugita does not appear to explicitly disclose an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object, adjustment unit; and a control unit that controls said adjustment unit when exposing said photosensitive object a plurality of times.

However, Kudo teaches an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object (paragraph [0030]-[0031] and Fig. 3, adjustment unit, supply pipe LS and LQ and valves DVLS, DVLWS, and DVL, controls the index of refraction by supplying the additive liquid to the space between the projection system and the photosensitive object. Adjusting the index of refraction, in turn adjusts the wavelength of exposure light in the space.); and a control unit that controls said adjustment unit when exposing said photosensitive object a plurality of times (Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (valves) to adjust the index of refraction and thereby, the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to include an adjustment unit to adjust wavelength and a control unit that controls the adjustment unit as shown by Kudo, in the exposure apparatus of Sugita since a wavelength adjustment and control unit is commonly used in the art to correct shifts in

wavelength emitted by the laser that occur over time in order to maintain correct equipment operation.

Regarding claim 29, Sugita in view of Kudo, as detailed in claim 27, further teaches said adjustment unit comprises a liquid supply mechanism that supplies any one liquid of a plurality of types of liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Kudo Fig. 3 and paragraphs [0030]-[0031], liquid supply mechanism, supply pipes LS, LQ, and exhaust pipe L in addition to valves DVLS, DVLWS, and DVL can supply and control the flow of ethyl alcohol, water, and a mixture of ethyl alcohol and water, supply a predetermined liquid to the space), whereby said control unit controls said adjustment unit so that said liquid supply mechanism supplies a predetermined liquid of said plurality of types of liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure, whereas in said another exposure said liquid supply mechanism supplies a liquid different from said predetermined liquid to said space (Kudo Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction and thereby, the wavelength).

It would have been obvious to one skilled in the art at the time of the invention to include a liquid supply mechanism that supplies a plurality of types of liquid to the space as shown by Kudo, in the exposure apparatus of Sugita since supplying a variety of liquids in a wavelength adjustment and control unit is commonly used in the art to

correct shifts in wavelength emitted by the laser that occur over time in order to maintain correct equipment operation, while ensuring that the liquids used in the immersion space do not adversely effect imaging due to interaction with the surface of the photosensitive film on the object to be exposed.

Regarding claim 32, Sugita, as detailed in claim 31 above, does not appear to explicitly describe wherein in said first exposure apparatus, a predetermined liquid is filled between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object.

However, Kudo discloses wherein in said first exposure apparatus, a predetermined liquid is filled between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object (paragraph [0007], photosensitive object is exposed through a liquid with a refractive index control and adjustment device).

It would have been obvious to one skilled in the art at the time of the invention to have included a liquid filling the space between the projection system and the photosensitive object as shown by Kudo, in the exposure apparatus of Sugita since an immersion fluid is commonly used in the art to increase the numerical aperture of the projection exposure system to enable patterning of smaller feature sizes.

Regarding claim 33, Sugita in view of Kudo, as detailed in claim 32 above, further teaches wherein in said second exposure apparatus, another liquid having a refractive index smaller than said predetermined liquid is filled between said projection optical system and said photosensitive object when said exposure light is projected on

said photosensitive object (Kudo paragraph [0007], index of refraction of liquid is adjusted, creating an immersion liquid of a different type, and [0033], the refractive index of the liquid is decreased by adding less ethyl alcohol).

It would have been obvious to one skilled in the art at the time of the invention to have included liquid with a lower index of refraction than another liquid as shown by Kudo, in the exposure apparatus of Sugita since an immersion fluid different refractivity is commonly used to allow improved control of numerical aperture for different process conditions.

7. Claims 6-8, 19-21, 28, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita as modified by Kudo as applied to claims 2, 13, and 32 above, and further in view of Fujishima et al. (JP2000-058436, translation is provided).

Regarding claims 6-8, Sugita as modified by Kudo, as detailed in claim 2 above, teaches that said at least one exposure is performed prior to said another exposure (Sugita, [0024], two exposure steps are performed. Also, Paragraphs [0053] and [0063], an F2 laser (Fig. 11), with a wavelength of 157 nm, used in one apparatus was used for a first exposure and an X-ray exposure apparatus (Fig. 13) was used for a second exposure. The F2 laser exposure wavelength is larger than that of the exposure apparatus using X-ray exposure). Sugita further teaches wherein said at least one exposure is performed after said another exposure is performed (Sugita, paragraphs [0024], [0053], and [0063], two exposure steps occur for a photosensitive object, one step in an exposure apparatus using a F2 laser light source and another step in an X-

ray exposure apparatus). However, Sugita as modified by Kudo, in an alternative interpretation, does not appear to explicitly describe wherein in said another exposure, said space is in a state not filled with liquid.

However, Fujishima et al. teaches wherein in said another exposure, said space is in a state not filled with liquid (paragraph [0007]-[0009] and Fig. 1, an exposure apparatus is capable of imaging a photosensitive object via a space not filled with liquid, though it is also capable of imaging the object through liquid contained in container 3 that can be placed in the imaging beam path between the projection system 2 and the photosensitive object 5a).

It would have been obvious to one skilled in the art at the time of the invention to have a space between the projection system and the photosensitive object not filled with liquid during at least one exposure as shown by Fujishima et al., in the exposure apparatus of Sugita in view of Kudo since performing one exposure in a state in which the space between the projection system and the object to be exposed is not filled with liquid is commonly known in the art to be a faster method of exposure than immersion exposure, thereby improving throughput in multiple exposure techniques.

Regarding claims 19-21, Sugita as modified by Kudo, as detailed in claim 13 above, teaches that said exposure under said first exposure condition is performed prior to said exposure under said second condition (Sugita, [0024], two exposure steps, one must occur before the other), and that said exposure under said first exposure is performed after said exposure under said second exposure has been performed (Sugita, [0024], two exposure steps, one must occur before the other). However, Sugita

as modified by Kudo, in an alternative interpretation from that which is described above, does not appear to explicitly describe wherein exposure under said second exposure condition is a dry exposure performed in a state where said space is not filled with liquid.

However, Fujishima et al. teaches wherein exposure under said exposure condition is a dry exposure performed in a state where said space is not filled with liquid (paragraph [0007]-[0009] and Fig. 1, an exposure apparatus is capable of imaging a photosensitive object via a space not filled with liquid, though it is also capable of imaging the object through liquid contained in container 3 that can be placed in the imaging beam path between the projection system 2 and the photosensitive object 5a).

It would have been obvious to one skilled in the art at the time of the invention to have a space between the projection system and the photosensitive object not filled with liquid during an exposure as shown by Fujishima et al., in the exposure apparatus of Sugita in view of Kudo since performing one exposure in a state in which the space between the projection system and the object to be exposed is not filled with liquid is commonly known in the art to be a faster method of exposure than immersion exposure, thereby improving throughput in multiple exposure techniques.

Regarding claim 28, Sugita as modified by Kudo, as detailed in claim 27, further teaches said adjustment unit comprises a liquid supply mechanism that supplies a predetermined liquid so that in a space between said projection optical system and said stage, at least a space between said projection optical system and said photosensitive object on said stage is filled with said liquid (Kudo Fig. 3 and paragraphs [0030]-[0031],

liquid supply mechanism, supply pipes LS and LQ and valves DVLS, DVLWS, and DVL, supply a predetermined liquid to the space), whereby said control unit controls said adjustment unit so that said liquid supply mechanism supplies said liquid to said space between said projection optical system and said photosensitive object on said stage in said at least one exposure (Kudo Fig. 3 and paragraph [0031], control unit, CPU 2, controls the operation of the adjustment unit (pipes and valves) to adjust the index of refraction and thereby, the wavelength). However, Sugita in view of Kudo does not appear to explicitly describe wherein in said another exposure said liquid supply mechanism does not supply said liquid to said space.

However, Fujishima et al. teaches in said another exposure said liquid supply mechanism does not supply said liquid to said space (paragraph [0007]-[0009] and Fig. 1, an exposure apparatus is capable of imaging a photosensitive object via a space not filled with liquid, though it is also capable of imaging the object through liquid contained in container 3 that can be placed in the imaging beam path between the projection system 2 and the photosensitive object 5a).

It would have been obvious to one skilled in the art at the time of the invention to have a space between the projection system and the photosensitive object not filled with liquid during an exposure as shown by Fujishima et al., in the exposure apparatus of Sugita in view of Kudo since performing one exposure in a state in which the space between the projection system and the object to be exposed is not filled with liquid is commonly known in the art to be a faster method of exposure than immersion exposure, thereby improving throughput in multiple exposure techniques.

Regarding claim 34, Sugita as modified by Kudo, as detailed in claim 32 above, does not appear to explicitly describe wherein in said second exposure apparatus, liquid does not exist between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object.

However, Fujishima teaches wherein in said second exposure apparatus, liquid does not exist between said projection optical system and said photosensitive object when said exposure light is projected on said photosensitive object (paragraphs [0007]-[0009] and Fig. 1, an exposure apparatus is capable of imaging a photosensitive object via a space not filled with liquid, though it is also capable of imaging the object through liquid contained in container 3 that can be placed in the imaging beam path between the projection system 2 and the photosensitive object 5a).

It would have been obvious to one skilled in the art at the time of the invention to have included a dry exposure between the projection system and the photosensitive object as shown by Fujishima, in the exposure apparatus of Sugita in view of Kudo since dry lithography is commonly used in the art to simplify equipment complexity and to save space.

8. Claims 10 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita as applied to claims 1 and 12 above, and further in view of the second embodiment of Sugita.

Regarding claim 10, Sugita, as detailed in claim 1 above, does not appear to explicitly describe wherein in said at least one exposure, a phase shift method is used.

However, the second embodiment of Sugita discloses wherein in said at least one exposure, a phase shift method is used (paragraph [0069], phase shift mask and ArF excimer laser can be used).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as shown by the second embodiment of Sugita, in the exposure apparatus of the first embodiment of Sugita since a phase shift mask in an exposure apparatus is commonly used in the art to improve pattern resolution.

Regarding claim 23, Sugita, as detailed in claim 12 above, does not appear to explicitly describe wherein in said exposure under said first exposure condition, a phase shift method is used.

However, the second embodiment of Sugita discloses wherein in said exposure under said first exposure condition, a phase shift method is used (paragraph [0069], phase shift mask and ArF excimer laser can be used).

It would have been obvious to one skilled in the art at the time of the invention to use a phase shift mask as shown by the second embodiment of Sugita, in the exposure apparatus of the first embodiment of Sugita since a phase shift mask in an exposure apparatus is commonly used in the art to improve pattern resolution.

9. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita in view of Kroyan et al.

Regarding claim 27, Sugita teaches an exposure apparatus that performs a plurality of times of exposure on a same photosensitive object (Abstract, solution, an exposure system to pattern a photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate), said apparatus comprising: a stage that holds said photosensitive object (Fig. 24, stage 199); a projection optical system that projects an exposure light on said photosensitive object (Fig. 24, projection system 196), and in at least one exposure of said plurality of times, said substantial wavelength of said exposure light in said space is different from the wavelength in another exposure (paragraph [0024]). However, Sugita does not appear to explicitly describe an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object, adjustment unit; and a control unit that controls said adjustment unit when exposing said photosensitive object a plurality of times.

However, Kroyan et al. teaches an adjustment unit that adjusts a substantial wavelength of said exposure light in a space between said projection optical system and said photosensitive object (Fig. 8A adjustment unit, PZT driver or piezo stack, lever arm, and stepper motor, 84 controls the wavelength by adjusting the mirror); and a control unit that controls said adjustment unit when exposing said photosensitive object a plurality of times (Fig. 8A, control unit, LNP processor, controls the operation of the adjustment unit (PZT stack and lever arm as well as stepper motor) to adjust the mirror and control the output wavelength, which is monitored by a wave meter).

It would have been obvious to one skilled in the art at the time of the invention to include an adjustment unit to adjust wavelength and a control unit that controls the adjustment unit as shown by Kroyan et al., in the exposure apparatus of Sugita since, as shown by Kroyan et al., a wavelength adjustment and control unit is commonly used in the art to correct shifts in wavelength emitted by the laser that occur over time in order to maintain correct equipment operation (paragraph [0002]).

10. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sugita in view of Ando et al. (US Patent No. 5,989,759, referred to as Ando hereinafter).

Regarding claim 35, Sugita does not appear to explicitly describe wherein a number of said first exposure apparatus is larger than a number of said second exposure apparatus.

However, Ando discloses wherein a number of said first exposure apparatus is larger than a number of said second exposure apparatus (Fig. 1, there are more electron beam exposure devices 2 than deep-UV stepper 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have a larger number of one type of exposure apparatus than another type of exposure apparatus taught by Ando in the exposure system taught by Sugita, since, as shown by Ando, including more of one type of exposure apparatus than another type of exposure apparatus can improve throughput by increasing the number of the

throughput-limiting exposure apparatus while ensuring a high resolution (col. 2, lines 31-36 and 39-41).

Response to Arguments

11. Applicant's arguments and amendments, see page 10, lines 13-15, filed 5/13/2009, with respect to claim objections for claims 12 and 22 have been fully considered and are persuasive. The objections to claims 12 and 22 have been withdrawn.

12. Applicant's arguments and amendment, see page 10, lines 16-22, filed 5/13/2009, with respect to the 112, second paragraph rejection for claim 31 have been fully considered and are persuasive. The 112, 2nd paragraph rejection for claim 31 has been withdrawn.

13. Applicant's arguments and amendment, see page 10, lines 23-24 and page 11, lines 1-3, filed 5/13/2009, with respect to the 112, second paragraph rejection for claim 35 have been fully considered and are persuasive. The 112, 2nd paragraph rejection for claim 35 has been withdrawn.

14. Applicant's arguments filed 5/13/2009 have been fully considered but they are not persuasive. Applicant argues on page 11, lines 6-11 that Sugita does not expose each of a plurality of areas. However, upon careful review of the amendment and the prior art, the examiner respectfully disagrees since Sugita does teach "each of a plurality of areas on said photosensitive object is exposed by said plurality of times of

exposure, and after said plurality of areas are exposed by one of said at least one exposure and said another exposure, said plurality of areas are exposed by the other of said at least one exposure and said another exposure" since the Abstract of Sugita describes an exposure process for exposing periodic patterns (each of a plurality of areas") in which a rough exposure step roughly exposing patterns and a fine exposure step overlaps exposure with the latent images from the rough exposure step. Thus, the examiner does not find Applicant's arguments persuasive and the rejection of claim 1 over Sugita is maintained. For similar reasons, the rejections of claims 12 and 31 are maintained over Sugita.

15. Applicant's arguments regarding the rejection of claim 27 over Sugita as modified by Kudo or Sugita as modified by Kroyan filed 5/13/2009 have been fully considered but they are not persuasive. Applicant argues on page 11, lines 22-24 and page 12, lines 1-9 that Sugita does not teach exposing a same photosensitive object since Sugita uses different exposure apparatuses. However, upon careful review of the amendment and the prior art the examiner respectfully disagrees since Sugita does teach exposing a same photosensitive object (Abstract, solution, an exposure system to pattern *a* photoreceptive substrate where fine and rough exposure is performed at the same positions on the substrate). Thus, the examiner does not find Applicant's arguments persuasive and the rejection of claim 27 over Sugita as modified by Kudo or Sugita as modified by Kroyan is maintained.

16. Regarding the rejection of claims 9, 22, and 36 over Sugita as modified by Kroyan in the previous office action, the amendment of claims 1, 12, and 31 necessitate

the application of a different interpretation of claims 9, 22, and 36. Thus, claims 9, 22, and 36 are rejected over Sugita in the current office action. The Applicant argues with respect to claims 9, 22, and 36 on page 13, lines 1-11, that Kroyan does not teach the each different wavelength as currently described in amended claims 1, 12, and 31. Thus, the examiner has applied a new interpretation to claims 9, 22, and 36 as necessitated by the amendment of independent claims 1, 12, and 31 to read “each of a plurality of areas on said photosensitive object by said plurality of times of exposure, and after said plurality of areas are exposed by one of said at least one exposure and said another exposure, said plurality of areas are exposed by the other of said at least one exposure and said another exposure." Thus, the amendment has redefined what is meant by exposure so that "at least one exposure" and "said another exposure" are now interpreted to mean exposure of the plurality of areas on a photosensitive object with one wavelength, and then a different wavelength is used to expose the plurality of areas on a photosensitive object again according to claims 9, 22, and 36. Therefore, claims 9, 22, and 36 are rejected over Sugita in the current office action as necessitated by amendment.

Conclusion

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wegmann et al. (US PGPub 2008/0036982) discloses multiple exposures used to create an image on a substrate using an adjustable optical system of an exposure apparatus.

Suzuki (US PGPub 2004/0105085) discloses changing the wavelength during double exposures.

Ohtsuki et al. (US PGPub 2004/0012844) discloses changing the wavelength during double exposure.

18. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Riddle whose telephone number is (571)270-7538. The examiner can normally be reached on Monday- Thursday 7:00-17:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diane Lee can be reached on (571)272-2399. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. R./
Examiner, Art Unit 2851

/Diane I Lee/
Supervisory Patent Examiner, Art Unit 2851